

Air-Sea Interface and Marine Boundary-Layer Anemometers

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LONG-TERM GOALS

The long-term goal is to further the understanding of air-sea interactions processes including momentum, heat, water vapor and trace gas exchange under various meteorological and oceanographic conditions.

OBJECTIVES

The objective of this grant, a Defense University Research Instrumentation Program (DURIP) award, is to provide new, innovative instrumentation for air-sea interaction measurements from platforms such as the Research Platform R/P *FLIP*. The specific instrumentation obtained under this DURIP will provide wind and turbulence measurements from very near the sea surface (Laser Doppler Anemometer (LDA), 3-component) up through the marine atmospheric boundary layer (Wind Lidar). In addition, a GPS-inertial motion sensing unit will provide the complete velocity and orientation angles of the platform.

APPROACH

Three instruments were ordered under the DURIP award: A custom Laser Doppler Anemometer of small size; a vertical profiling Wind Lidar; and the motion sensing unit.

The Wind Lidar is from Leosphere, France. The lidar is contained in a small weather-proof container with the eye-safe beam pointing upwards. Profiles from ~40 to 200m above the unit are obtained once per second.

The motion unit is from Oxford Systems. This system has two GPS antennas to provide good heading data in low dynamic environments like a moored R/P *FLIP*. The unit also provides 1 and 100 Hz synchronization pulses tied to the GPS time clock for distribution to other data systems.

The LDA is from Measurement Science Enterprises, Inc. It consists of three laser beams which intersect at a small (1mmx1mmx1mm) volume. Velocity components will be obtained from the Doppler shift from the ubiquitous small (~1 micron) salt aerosols over the ocean.

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WORK COMPLETED

The three instruments have been ordered. The Leosphere WindCube and the Oxford GPS-Inertial system have been received. The MSE LDA is in the final stages of production.

RESULTS

The Leosphere WindCube was installed on a roof-top in June 2008 at UC Irvine and has operated well.



Figure 1: WindCube Test Installation @ UC Irvine

Sample plots of a wind profile and a time series under weak sea-breeze conditions at UCI are given in Figures 4 & 5.

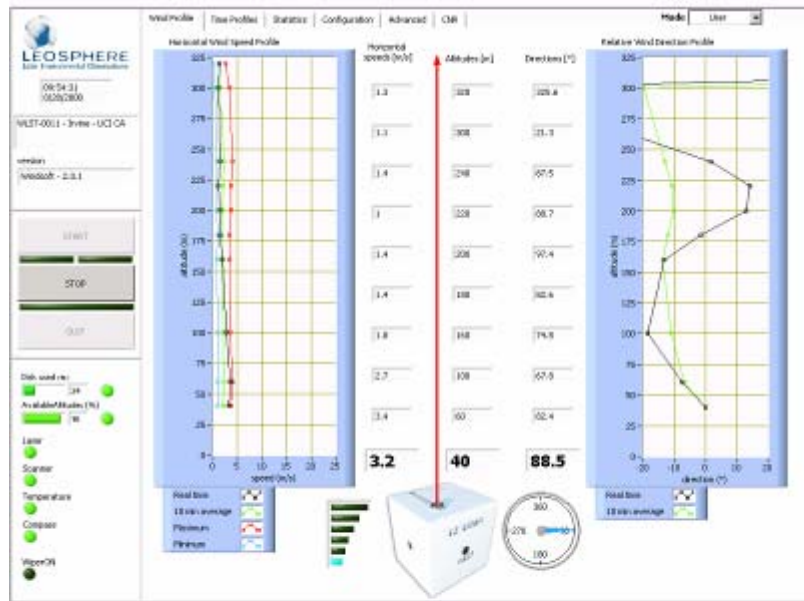


Figure 2: WindCube Profile @ UC Irvine

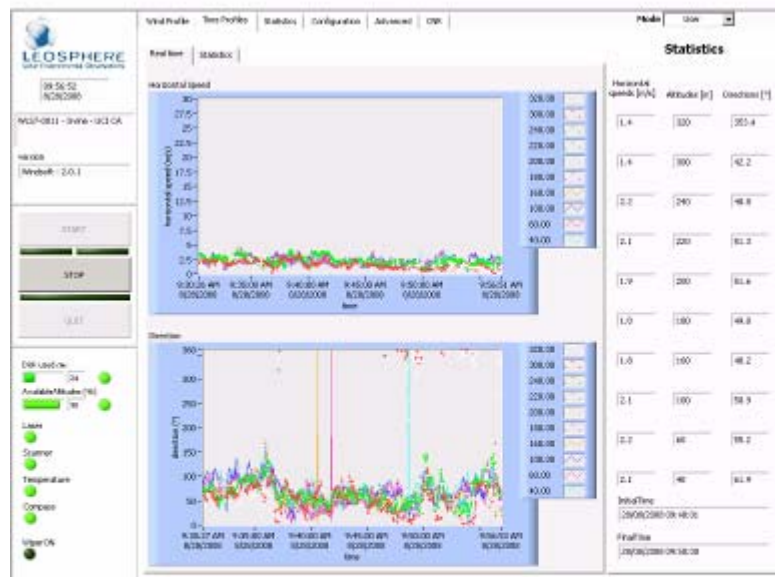


Figure 3: WindCube Time Series @ UC Irvine

The Oxford GPS/Inertial unit was tested on a short cruise of R/P FLIP in August 2008. It was installed on the “crow’s nest” on top of FLIP so to not interfere with other operations. The unit performed successfully, aligned at sea under the low dynamic conditions of FLIP drifting. The dual antennas of the R3400 unit provide a better true heading under such conditions. Examples of heading, pitch and roll of FLIP are shown below.

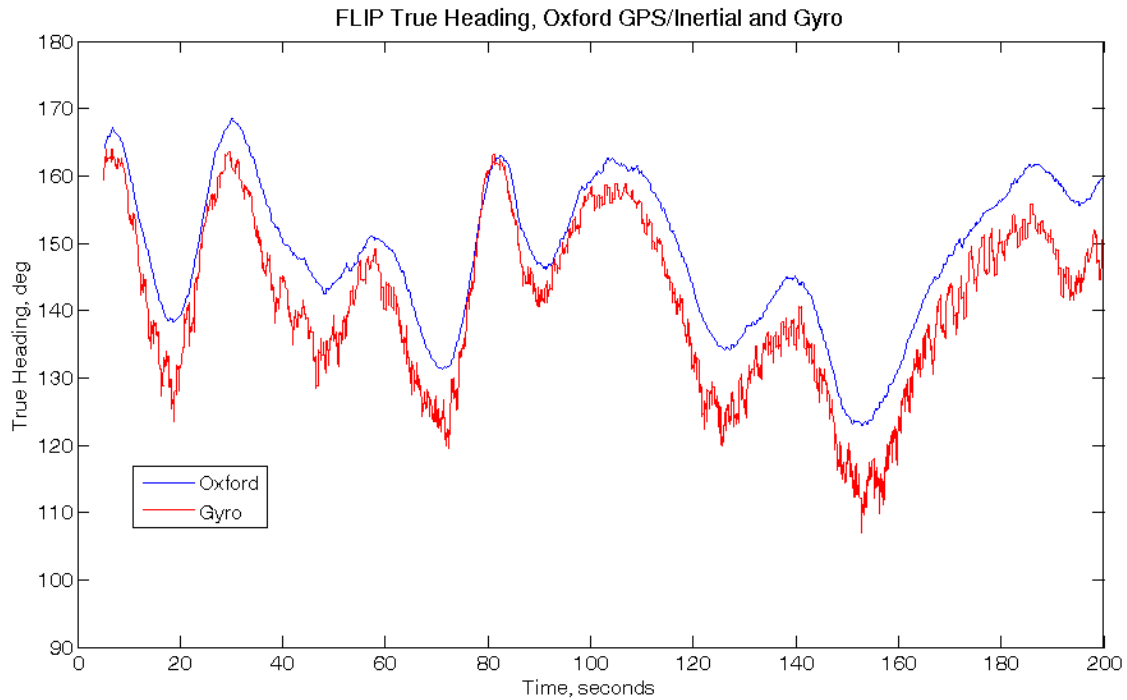


Figure 4. True Heading Comparison, Oxford and FLIP Gyro

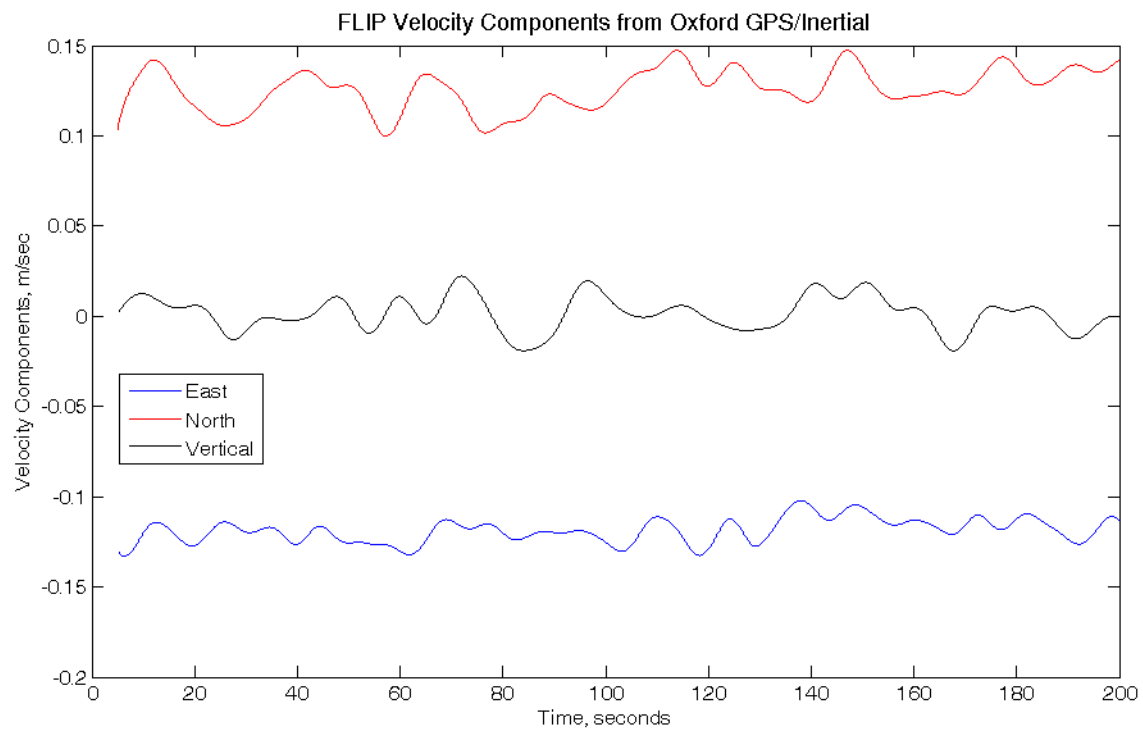


Figure 5. FLIP Velocity Components (Filtered)

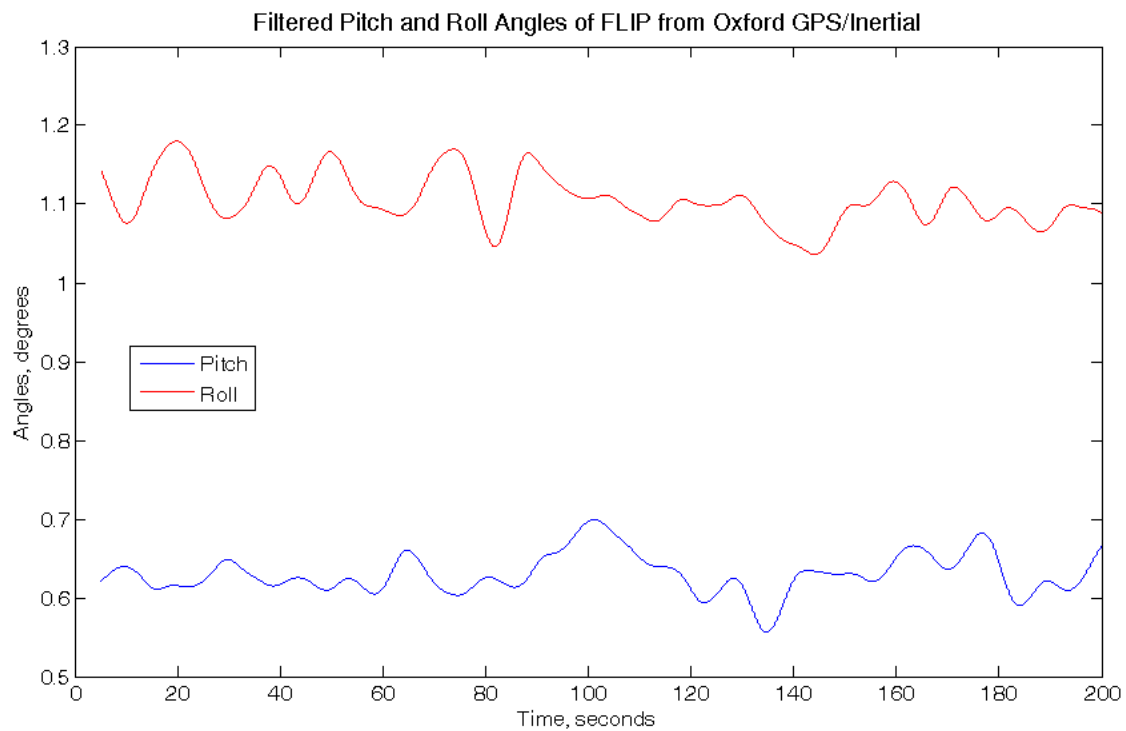


Figure 6. Pitch and Roll Angles

The MSE LDA is currently under construction. Continuing improvements by MSE in smaller laser modules and software will benefit application of the instrument.

IMPACT/APPLICATIONS

The initial application of these instruments will be in the ONR High Resolution Wind-Wave Departmental Research Initiative, FY2007-FY2011 during a trial cruise on R/P FLIP in Spring 2009 and the main experiment in Spring 2010.

TRANSITIONS

The portable Wind Lidar may have application as a substitute for a tall tower for wind profiles.

RELATED PROJECTS

ONR High Resolution Wind-Wave Departmental Research Initiative, FY2007-FY2011.

REFERENCES

Not applicable

PUBLICATIONS

Not applicable

PATENTS

Not applicable

HONORS/AWARDS/PRIZES

Not applicable